WHITE PAPER NO. 14 – REVIEW OF FOXVIEW DATABASE

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ABSTRACT

During the comment period, the Fox River Group (FRG) supplied the Wisconsin Department of Natural Resources (WDNR) and United States Environmental Protection Agency (EPA) with the FoxView Database, as part of their comments to the *Remedial Investigation for the Lower Fox River and Green Bay, Wisconsin* (RI) (RETEC, 2002a), *Feasibility Study for the Lower Fox River and Green Bay, Wisconsin* (FS) (RETEC, 2002b), and *Proposed Remedial Action Plan, Lower Fox River and Green Bay* (Proposed Plan) (WDNR and EPA, 2001). The FoxView Database was offered as an alternative to the Fox River Database (FRDB), an interactive web-enabled database developed for the WNDR and EPA to support the RI/FS and subsequent Record of Decision (ROD). This White Paper examines the data provided by the FRG in that database and analyzes the discrepancies between the FoxView Database and the FRDB. It further analyzed what impacts those discrepancies would have on the analyses in the RI/FS.

This White Paper's analyses conclude that the FoxView Database had a large data set not included in the FRDB, but that most of these data did not directly support the RI/FS project and were therefore not relevant for comparison. It was recommended that 20,052 records in FoxView be added to the FRDB along with those record additions currently in progress. After these additions, it was concluded that there would be a less than 1 percent difference in the final comparative record counts, indicating that with respect to the substantive, RI/FS supporting data, there is no effective difference between the FRDB and FoxView databases. This White Paper also examines problems with the FoxView Database including data source discrepancies, missing data, and data redundancies.

INTRODUCTION

This White Paper reviews the FoxView Database, which was supplied by the FRG with their comments to the RI/FS and Proposed Plan. The goal of the analysis was to determine what data, if any, existed in the FoxView Database but not in the FRDB, and the importance of that data to the RI/FS. In other words, is there data in FoxView that warrants inclusion into the FRDB? Furthermore, if such data was identified, this review attempted to determine why the data is not in the FRDB. The purpose of this White Paper is to provide a general description of the methodology followed and the results obtained.

The FoxView Database ("the Study Area Database") was assembled and submitted by the FRG as part of their comments on the Proposed Plan. According to the Lower Fox River and Green Bay Report: "The Study Area Database is intended to provide Lower Fox River and Green Bay investigators a common, complete, consistent, and verified resource for research and analysis into environmental trends. Inclusion of water column, sediment and biota samples was emphasized to facilitate analysis of the Study Area for the Fox River Group. Also, emphasis was given to parameters that were most relevant to the

needs of the Fox River Group, such as polychlorinated biphenyls (PCBs), solids, and radio-isotope results" (Limno-Tech, 2002, p. 1). FoxView contains nearly 2 million data records.

The FRDB is an interactive, web-enabled database developed by The RETEC Group, Inc. (RETEC) for the WDNR and EPA in support of the RI/FS and *Baseline Human Health and Ecological Risk Assessment for the Lower Fox River and Green Bay, Wisconsin, Remedial Investigation and Feasibility Study* (BLRA) (RETEC, 2002c). Development of the FRDB was conducted with two primary goals:

1) The identification and incorporation of available electronic data sets for immediate use in support of BLRA and RI/FS activities and the assessment of those data sets for overall quality and defensibility.

2) The generation of a useable database of Lower Fox River data produced through the identification, acquisition, review (quality assessment of validation), catalog, classification, and archive of all available data pertinent to the Lower Fox River BLRA and RI/FS (EcoChem, 2000, p. 1-1).

The FRDB, as used in support of the October 2001 RI/FS, contains 517, 682 records. Currently, additional data sets are being added to the FRDB which will increase the total number of records by approximately 20,000. (Interested parties may access the FRDB at www.tecinfodex.com/frdb.)

Prior to discussing the details of this analysis, it is imperative that two critical points be clear, one regarding the origins of requirements for inclusion into the FRDB and the other pertaining to the definition of "not in the FRDB."

- The FRDB was originally developed to support the goals of the Lower Fox River RI/FS and to support the subsequent Record of Decision (ROD). While a tremendous amount of data was and is available from studies conducted on the Lower Fox River, not all data supports these basic goals. Data that does not directly support the RI/FS and ROD has consciously been left out of the FRDB. Furthermore, data that does support the RI/FS and ROD is still subject to review prior to inclusion into the FRDB. Historically, data incorporated into the FRDB has been required to meet certain quality assurance/quality control (QA/QC) criteria prior to consideration for inclusion. The primary of these requirements is that the data have undergone a formal, third-party validation, or at a minimum have been reviewed by an independent third party. In lieu of having been reviewed by a third party, the data must have either been generated by a laboratory that had generated contemporary data for samples collected in association with this project (samples that HAVE undergone validation), or must have been delivered with a sufficient level of associated QA/QC data so as to be fully validatable in the future. Data not meeting the above criteria have not, and will not be, included in the FRDB.

- Data sets identified in this White Paper as not being in the FRDB are defined so by the Lower Fox River and Green Bay Database Report Version 6, Appendix A (Limno-Tech, 2002). In the report, the critical benchmark date for inclusion into the FRDB was the 1999 RI/FS submittal of the FRDB. Subsequent to the 1999 iteration of the FRDB, several data sets have been included into the FRDB, including several that the report points out as not in the FRDB. The report does identify some of these data sets as being added to the post-1999 RI/FS version of the database. Data sets that fall into this category will be identified later in this White Paper.

BACKGROUND AND METHODOLOGY

The impetus for this review was the apparent discrepancy between the FoxView database (1,905,621 records) and the FRDB (517,682 records). This difference of nearly 1.4 million records is what prompted this review. As will be discussed, the vast majority of these 1.4 million records fall into four categories. These categories will be referred to later in this memo when discussing various FoxView data groupings.

- **Category 1.** Data that do not directly support the RI/FS project. Examples would include river flow data, "administrative" data, or non-analytical data such as "Fish, dead (severity)" or "% Cloud Cover."

- **Category 2.** Data that is unable to be verified as meeting a demonstrable level of quality or data that may be redundant within another data set due to origin. This category is primarily represented by data collected under university (or similar) research programs. In these programs (typically), often no definable QA/QC procedures were in place or the data were part of a larger study (e.g. the Green Bay Mass Balance Study [GBMBS]) and are likely to be reported along with data from that study.

- **Category 3.** Data that was collected after the finalization of the 1999 RI/FS FRDB and has already been incorporated into the FRDB or is currently being incorporated into the FRDB. This includes data that has been collected 1999 to the present.

- **Category 4.** Data that has been previously unavailable to WDNR. This data includes the 2000 to present data collected by the FRG and its contractors. The data had not previously been made available to WDNR and consequently is not in the FRDB.

In order to gain an understanding of the information contained within FoxView, a series of simple count queries were conducted on the FoxView database to ascertain how much of what type of information was actually present. These counts were conducted at a relatively high level, but allowed significant portions of FoxView to be segregated out as non-pertinent information. The basic goal of this exercise was to analyze FoxView at a very gross level, to determine if large sections of the database could be grouped into common clusters. As this process proceeded, it was obvious that large sections of the

database could be identified as containing data of little or no value for supporting the RI/FS process.

The data in FoxView is organized by "group_name", which is somewhat analogous to the FRDB "analysis_type" field. Initial counts were conducted based upon this field. Table 1 – Breakout of Records in FoxView by Group Name, presents counts of the numbers of records in FoxView as grouped by "group_name" (Count of Total Records). Table 1 also presents the same count, limited to those data sets as being identified as not in the Phase I FRDB (Count of Total Records from Data Sets Identified as NOT Being in the FRDB). Also included in the table is a brief description of the "group_name" field.

Using Table 1 as a first screening, certain database records can be identified as having minimal value with respect to the RI/FS and risk assessment. These would include temperature, flow, administrative, unknown, and other (Tier 1 – data of a non-analytical nature and of little value to the RI/FS). Also included in this group would be physical, general inorganics, dissolved oxygen and oxygen demand, phosphorus, solid, bacteriological, and nitrogen (Tier 2 – data of an analytical nature, but still of little relative value to the RI/FS). Table 2 – Category 1 data, Tiers 1 and 2, presents a summary of those data in FoxView that do not warrant inclusion into the FRDB, as determined on the basis of the type of data under consideration. As is indicated, approximately 1.1 million records in FoxView, but identified as not being in the FRDB may be of little support for use on this project, and consequently do not warrant the effort required for incorporation into the FRDB. Nearly all data summarized in Table 2 falls into Category 1 as defined previously in this White Paper.

TABLE 1 BREAKOUT OF RECORDS IN FOXVIEW BY GROUP NAME

Group_name	Count of Total Records	Count of Total Records from Data Sets Identified as NOT Being in the FRDB	Description
Administrative	105,793	102,745	Non-analytical information such as sample collection locations, analytical instrument type, etc.
Bacteriological	32,630	32,630	Coliform analyses
Biological	27,780	21,823	Chlorophyll, plankton, etc.
Dioxins, Furans, Retenes, and Abietanes	2,359	1,604	
Dissolved Oxygen	54,130	53,380	
Flow	117,766	117,455	
General Inorganic	82,953	79,240	Inorganic “wet” chemistry analyses
General Organic	46,416	35,385	Miscellaneous organic analyses (including VOCs, SVOCs, pesticides, petroleum, wet chemistry)
Metal	88,070	84,503	
Miscellaneous	3,112	1,176	Similar to administrative
Nitrogen	111,749	108,105	Various nitrogen analyses
Other	9,203	8,256	Similar to administrative
Oxygen Demand	72,169	72,164	BOD and COD analyses
PCBs	521,084	105,383	Aroclor, congener, homolog, and total
Pesticide	47,125	30,403	Pesticides and herbicides
Phosphorus	81,624	79,933	Phosphorus/phosphate
Physical	205,332	184,127	Bulk density, dry weight, turbidity, etc.
Radiological	16,627	13,343	
Solid	164,320	149,455	Grain size, total, suspended, dissolved solids
Temperature	115,359	110,895	Air/water temperatures
Unknown	20	20	
Sum	**1,905,621**	**1,392,025**	

TABLE 2 CATEGORY 1 DATA TIERS 1 AND 2*

Tier	Group_name	Count of Total Records	Count of Total Records from Data Sets Identified as NOT Being in the FRDB	Description
1	Administrative	105,793	102,745	Non-analytical information such as sample collection locations, analytical instrument type, etc.
1	Flow	117,766	117,455	
1	Miscellaneous	3,112	1,176	Similar to administrative
1	Other	9,203	8,256	Similar to administrative
1	Temperature	115,359	110,895	Air/water temperatures
1	Unknown	20	20	
	Sum of Tier 1 Records:	*351,253*	*340,547*	
2	Bacteriological	32,630	32,630	Coliform analyses
2	Dissolved Oxygen	54,130	53,380	
2	General Inorganic	82,953	79,240	Inorganic "wet" chemistry analyses
2	Nitrogen	111,749	108,105	Various nitrogen analyses
2	Oxygen Demand	72,169	72,164	BOD and COD analyses
2	Phosphorus	81,624	79,933	Phosphorus/phosphate
2	Physical	205,332	184,127	Bulk density, dry weight, turbidity, etc.
2	Solid	164,320	149,455	Grain size, total, suspended, dissolved solids
	Sum of Tier 2 Records:	*804,907*	*759,034*	
Sum of Tier 1 and 2 Records:		**1,156,160**	**1,099,581**	

Note:
* Tier 1 data is information that is not of an analytical nature, and has little value to the RI/FS. Tier 2 data is more analytical in nature, but is generally still of little relative value to the RI/FS.

The following provides a brief summary of the record distribution within FoxView:

Total Records in FoxView	1,905,621
Records in FoxView Identified as Not Being in FRDB (count from FoxView)	1,392,025
Records in FoxView with Minimal Value for FRDB (from Table 2)	1,099,581
Residual Records that Might Warrant Inclusion into FRDB	292,444

As indicated, there are approximately 292,000 records in FoxView, not in FRDB, that would appear to be potentially applicable analytical data records that should be incorporated into the FRDB. Further analysis of these records, however, indicates that only a percentage of these results actually are fit for inclusion into the FRDB. Table 3 – Potentially Important Data, presents a list of data sources, drawn from FoxView that have data potentially pertinent for inclusion into the FRDB. These data sources are all identified within FoxView as not being in the FRDB.

TABLE 3 POTENTIALLY IMPORTANT DATA

Source_no	Source	Source Notes	Description	Group_code	Group_name	Count of Total Results
1101	STORET	2	EarthInfo, Inc. CD-ROM STORET 1996 Region 5:3 States Indiana, Michigan	8	Metal	25,495
				7	General organic	4,061
				11	Pesticide	3,269
				3	Biological	2,442
				14	Radiological	986
				19	PCBs	448
				20	Dioxins, furans, retenes, & abietanes	105
1102	STORET	2	EarthInfo, Inc. CD ROM STORET 1996 Region 5:4 States Minnesota, Wisconsin	8	Metal	56,316
				19	PCBs	38,894
				11	Pesticide	20,958
				7	General organic	20,098
				3	Biological	14,673
				14	Radiological	1,164
				20	Dioxins, furans, retenes, & abietanes	221
2401	BBL	2	PCB, PAH, TSP, and temp data for air samples	7	General organic	9
				19	PCBs	9
2402	BBL	2	PCB congener-specific data for air samples	19	PCBs	1,260
2403	BBL	2	Total PCB data for snow and rain precipitation composite samples	19	PCBs	38
2404	BBL	2	Data for total PCBs, PCB transfer from water to air (flux), and physical data for water and air	19	PCBs	362
3101	LMMBS	3	Congener PCBs, TOC, mercury, moisture data for sediment samples collected in 1994	19	PCBs	498
				7	General organic	5
				8	Metal	5
3203	LMMBS	3	Dissolved and particulate congener PCBs, Conventionals, and mercury collected in 1994–1995 in Green Bay	19	PCBs	6,285
				7	General organic	78
				8	Metal	14
3301	LMMBS	3	Phytoplankton and zooplankton data from water samples in the Fox River, Menominee River and Green Bay	3	Biological	1,173
4202	BBL	3	Sediment & onshore sediment processing data (10/21/98–12/30/99) – density, grain size, mercury, PCB Aroclors and congeners, TOC	19	PCBs	7,355
				8	Metal	157
				7	General organic	110
4302	BBL	3	Sediment & onshore sediment processing data (8/16/99–7/18/00) – density, grain size, mercury, PCB Aroclors and congeners, solids, specific gravity, TOC, water content	19	PCBs	11,285
				7	General organic	3,020
				8	Metal	617
4303	Ft. James	4	Processed sediment, post-dredge sediment, and treated effluent PCBs and physical characteristics from SMU 56/57 during dredging	19	PCBs	714
				8	Metal	24
4304	EPA	4	Water, sediment, effluent, treatment process PCBs, mercury, TSS, solids, BOD, ammonia, and TP data from SMU 56/57 post-dredge	19	PCBs	53
				8	Metal	43
4402	BBL	3	1998–1999 caged fish studies at Deposit N and SMU 56/57 from BBL database LTI.mdb (1/25/01)	19	PCBs	1,877
				3	Biological	128
				7	General organic	128

TABLE 3 POTENTIALLY IMPORTANT DATA

Source_no	Source	Source Notes	Description	Group_code	Group_name	Count of Total Results
5301	BBL	3	Water column data (3/10–9/24/98); sediment core and surface sediment data (6/1–8/5/98); and fish and trend fish data (6/2–7/24/98); PCBs, pesticides, organic carbon, solids, mercury, semivolatiles, and metals	19	PCBs	19,018
				11	Pesticide	5,872
				7	General organic	5,059
				8	Metal	1,718
				3	Biological	645
				14	Radiological	462
				20	Dioxins, furans, retenes, & abietanes	61
5401	FRG 2000	4	Radioisotope data (cesium-137, lead-210, beryllium-7) for sediment cores collected below De Pere dam and between Lake Winnebago outlet and De Pere dam	14	Radiological	10,731
5402	FRG 2000	4	Sediment grab samples for Aroclor PCBs, TOC, TSS and grain size distribution along Fox River	19	PCBs	1,065
				7	General organic	775
5403	FRG 2000	4	Water column Aroclor PCBs, congener PCBs (subset of samples), TOC/DOC/POC, TSS results along Fox River and selected tributaries. Water column solids grain size distribution by LALLS method (also known as Malvern analysis) from Heidleberg College	19	PCBs	5,791
				7	General organic	338
				3	Biological	128
5501	BBL	4	PCB, TOC, physical characteristics measured at 16 stations in inner Green Bay	19	PCBs	240
				7	General organic	150
6605	BBL	2	Aroclor PCB results for 6 fish species at 8 sites in Lake Michigan (4/95–10/2000)	3	Biological	388
				7	General organic	194
				19	PCBs	194
6609	BBL	3	Aroclor PCB data for fish samples collected from 4/96 to 8/98 in the Fox River	3	Biological	412
				7	General organic	412
				19	PCBs	312
6801	BBL	2	Dissolved and particulate PCB data for water samples	19	PCBs	15
7106	BBL	3	PCB congener, Aroclor, and pesticide data for fish, birds, and a mink in 1996 and 1997 for Green Bay, the Fox River, additional lakes and tributaries, and hatcheries	19	PCBs	6,701
				3	Biological	577
				20	Dioxins, furans, retenes, & abietanes	520
				7	General organic	394
				11	Pesticide	198
8101	BBL	2	PCBs in sediments	19	PCBs	110
8202	BBL	2	Total, dissolved, and suspended PCB data and physical data for water samples	19	PCBs	275
				7	General organic	140
9101	BBL	2	PCB, dioxin, and metals data for sediment samples	20	Dioxins, furans, retenes, & abietanes	221
				8	Metal	78
				19	PCBs	65
				7	General organic	13
9102	Exponent	2	Brazner & DeVita. PCBs, DDE, and mercury in young-of-the-year littoral fishes from Green Bay, Lake Michigan, Tables 1 & 2. *J. Great Lakes Res*. 24(1):83–92, *Internat. Assoc. Great Lakes Res*., 1998	3	Biological	36
				7	General organic	36
				8	Metal	36
				11	Pesticide	36
				19	PCBs	36
9103	BBL	2	Pesticide, PCB, and PAH biota data	19	PCBs	77
				11	Pesticide	70
				7	General organic	21

TABLE 3 POTENTIALLY IMPORTANT DATA

Source_no	Source	Source Notes	Description	Group_code	Group_name	Count of Total Results
				3	Biological	7
9104	BBL	2	PCB, PCDD, PCDF data for eggs and chicks	20	Dioxins, furans, retenes, & abietanes	476
				19	PCBs	140
				7	General organic	128
				3	Biological	28
9201	CH2M HILL	3	Surficial sediment samples for Aroclor PCBs, TOC, and solids in Little Lake Butte des Morts	19	PCBs	1,988
				7	General organic	141
9301	BBL	2	Retene, related diterpene hydrocarbons, and PCBs in sediments of the Lower Fox River and Green Bay	7	General organic	75
				19	PCBs	15
9302	BBL	2	Dissolved and particulate PCB data for water samples	19	PCBs	16
9401	BBL	2	Sediment PCBs	19	PCBs	216
9402	BBL	2	Urban area PCB loads from storm drains and catch basins	19	PCBs	10

The column in Table 3 identified as "Source Note" is an indicator of the disposition of the data source with respect to inclusion into the FRDB. One of three indicators (2, 3, or 4) has been assigned to each data set to identify why the data set is not in the FRDB, or at least why it is apparently not in the FRDB. These indicators are equivalent to the data categories identified on page 1 of this White Paper.

Data identified as being "Category 2" data will not be incorporated into the FRDB, primarily because these data sets fail the QA/QC requirements set forth for inclusion into the FRDB. Furthermore, these data sets have a great likelihood of containing redundant data that has previously been incorporated into a larger data set.

The data identified as "Category 3" data is either in the FRDB (post-1999) or is currently in the process of being incorporated into the FRDB. "Category 4" data is suitable for incorporation into the FRDB now that it is available to WDNR, assuming it meets the required QA/QC level.

SUMMARY AND RECOMMENDATIONS

Of the approximately 1.4 million records that FoxView identifies as not in the FRDB, the categorical breakdown is as follows:

Category Number	Number of Data Sources	Records
1	38 (all)	1,288,711
2	16	4,830
3	10	77,225
4	6	20,052
	Total	**1,392,025****

** When FoxView is queried for all data not in FRDB by group, the total number of records does not match the results of the query when conducted by group subsets. This is likely due to some data redundancy within the database on the key fields used in the query. As the discrepancy is only 1,207 records (0.06 percent of the total database), no effort was expended to determine the exact source of the difference.

As indicated, only 20,052 records (Category 4) remain to be added to the FRDB (not including in-process data additions that account for approximately 20,000 additional records). When these numbers are taken into account and an examination of the total records in FoxView and the FRDB is conducted, the following result is obtained:

FRDB		FoxView	
Total FRDB Records	517,682	Total FoxView Records	1,905,621
Approximate Records Yet to be Added (sum of Category 4 data and in-process data)	40,052	FoxView Records NOT to be Added to FRDB	1,351,973
Comparative FRDB Record Count	557,734	Comparative FoxView Record Count	553,648

It is recommended that the new data sets (the 20,052 Category 4 data records) be included into the FRDB, along with those record additions currently in progress. Subsequent to completion of this effort, the FRDB will consist of approximately 560,000 records. There will then be a less than 1 percent difference in the final comparative record counts, indicating that with respect to the substantive, RI/FS supporting data, there is no effective difference between the FRDB and FoxView databases.

REVIEW COMMENTS

During the process of reviewing the apparent data discrepancies between FoxView and the FRDB, several observations were noted that have potential impacts on the accuracy of the comparisons contained herein. These discrepancies are beyond the scope of this task, but are listed here for completeness sake and additional consideration.

Data Source Discrepancies

There are certain discrepancies between source descriptions as they are defined within FoxView and how they are defined in the Lower Fox River and Green Bay Database Report Version 6.0 (Limno-Tech, 2002). The following provides several examples to illustrate this point.

Source Number	FoxView Definition (from description field in source table)	Report Definition (from Appendix A)
1101	Earthinfo, Inc. CD-ROM STORET 1996 Region 5:3 States Indiana, Michigan	WI STORET
1102	Earthinfo, Inc. CD-ROM STORET 1996 Region 5:3 States Minnesota, Wisconsin	MI STORET

There is confusion between the definitions as to which data source contains data from which state.

Missing Data in FoxView

While the purpose of this exercise was to look at data in FoxView, but not in the FRDB, it should be noted that certain data are also not in FoxView. This following discussion is by no means comprehensive, but does point out that FoxView is also not comprehensive. It was discovered that a current data set (CH2M HILL data from Little Lake Butte des Morts – FoxView source number 9102) is only partially included in FoxView. While the original data source for this data contains results for 447 environmental samples, FoxView contains results for only 260 samples. A brief analysis of the missing samples shows that the missing data is from the July 2001 sampling event, from sediment samples collected at greater than 100-cm depths, and from the "woodchip" deposits. Furthermore, the Database Report identifies that several small data sets were omitted from inclusion into FoxView.

No attempt was made to verify the overall completeness of the data contained within FoxView. The example cited above was discovered while conducting this analysis. Other similar situations may or may not exist.

Potential Data Redundancies

Within the data sets incorporated into FoxView, there is a great potential for redundancy between data sets. Much of the information collected by individual researchers in the smaller studies/data sets was used in the larger GBMBS. Additionally, much of the data contained in STORET is data generated under other programs and made available in STORET. Where data from multiple sources has been compiled into a comprehensive data set (STORET, GBMBS), and then that comprehensive data is again mixed with the original source data, the potential is great for redundancies to occur.

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